DOCUMENT RESUME

ED 183 194 IR 008 136

AUTHOR Dennis, J. Richard
TITLE The School Administrator's Introduction to Computing. The Illinois Series on Educational Application of Computers, No. 16e.
INSTITUTION Illinois Univ., Urbana. Dept. of Secondary Education.
SPONS AGENCY EXXON Education Foundation, New York, N.Y.
PUB DATE 79
NOTE 30p.: Best copy available: For related documents, see IR 008 123-140, IR 008 142, and IR 008 144.

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS *Administrative Personnel: *Computer Oriented Programs: Data Bases: *Guidelines: Information Needs: Information Sources: *Management Information Systems: *School Administration: Selection: *Use Studies

ABSTRACT

This discussion of the administrative uses of computers from the perspective of the school administrator is concerned with both the types and sources of information involved in school administration, and specific uses of this information. The paper focuses on those administrative tasks that can be effectively computerized in defining the role of the computer for each task. Topics covered include (1) basic types of information required for school management--student, financial, and personnel; (2) basic models of information flow in schools--"trickle-down" and "percolate-up" models; and (3) selection of computer systems, including software, performance requirements, estimating quality of service, and operating personnel requirements. Schools seeking to avail themselves of computers for use in administration and instruction are advised to concentrate on a similar analysis and definition of information uses and requirements before equipment is selected. This resource for preservice and inservice training includes a listing of a variety of school district data base documents and a 27-item bibliography. (CMV)

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Number 16e

Illinois Series on Educational Application of Computers

ED183194

THE SCHOOL ADMINISTRATOR'S INTRODUCTION TO COMPUTING

J.Richard Dennis

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IR008136

To the reader,

This is one of a series of documents prepared as resources for the preservice and inservice training of teachers. The general theme of all items in this series is "teaching with or about computers". The booklets are the collective work of a variety of staff and students (both present and former) of the College of Education, University of Illinois at Urbana-Champaign. The project was generously supported between 1977 and 1979 by a grant from the EXXON Education Foundation. All responsibility for the content of these documents rests with the authors and does not reflect necessarily the views of the EXXON Foundation. It was my extreme pleasure to direct this effort throughout.

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THE SCHOOL ADMINISTRATOR'S INTRODUCTION TO COMPUTING

Since the 1960's, computers generally have become a relatively common phenomenon in schools. Originally found only in large school districts, and used only to facilitate the work of administrators, growth of their use has been rapid. Today, just over 50% of secondary schools use computers for administrative tasks and between 30% and 40% of them use computers to facilitate instruction (Bukosky and Korotkin, 1977 and Dennis, Dillhurst, and Muiznieks, 1977). Added to this growth, the 1970's has seen the rapid emergence and expansion of micro-electronics technology which has made vast amounts of computing power available to even the smallest school for a fraction of the former costs.

The history of school administrative computing has not been a smooth one for most participants. Procurement of equipment has put demands on the administrator not easily satisfied by prior training and experience. Operation of computing equipment has created demands for differently trained personnel. But, in satisfying these demands has come the danger of creating new barriers between the decision maker and the information he needs to carry out his tasks. Furthermore, in introducing computers into instruction, it has been difficult to identify benefits (other than novelty) derived from the investment.

In this paper, we shall address the topic of administrative uses of computers from the perspective of the school administrator. Other papers in this series provide a detailed introduction to instructional uses of computers. The intent of all papers in this series is to assist school personnel in getting maximum benefit from investments in computing. Our theme throughout the series is that technical knowledge of computers is <u>not</u> the most important missing link for the school computer user. Rather, the more important missing link usually is a very conscious and precise definition of the tasks of the school persons themselves. In the discussion that follows, we shall focus on some of the tasks of administrators that can yield to effective computerization.

The Administrator and Information

One is tempted in a paper of this type to start with the question "What can computers do for the school administrator?" As we hinted earlier, however, this is the wrong first question to ask. Instead, we should ask the questions:

1. What does the school administrator do?

2. What does he need in order to accomplish his tasks?

Notice that these questions have no mention of computers.

A large portion of a school administrator's duties involve management. The things that are managed are people (of several types), money, facilities and other resources, learning, and time. One of the most important bases or ingredients of management is information. The school administrator cannot function without information. And the quality of the information available determines, in large measure, the quality of the management achieved.

One might be tempted to stop at the mention of information and conclude that providing information will be a valuable role for a computer in school administration. After all, one of the things computers do best is to process information. However, this function is still much too vague and general to act on. We need to ask still more specific questions about information:

1. What are the types and sources of information involved in school administration?

2. What are the specific uses of information in administering "my" school(s)?

A majority of the rest of this paper will address these two general questions. Notice, also, that neither of these questions specifically mentions a computer. Our major message to the school administrator is that before embarking on procurement of resources like computers, one first should detail the uses to be made of the resources. So, we shall discuss the detailing of information sources and uses within a school system. Our claim is that careful attention to the detailing of information sources and uses specifically will define the role of a computer (if one is sought), and will minimize the technical knowledge needed by the administrator in seeking such equipment.

A bit of vocabulary at this point will help us bridge to consideration of computers later. A computer person frequently refers to information as data and collections of information are called data bases. A process (including the equipment) for handling information is referred to as a data system or more specifically as a data base management system.

SCHOOL INFORMATION TYPES AND USES

There are three basic types of information required for conducting school management:

1. Student Information
2. Financial Information
3. Personnel Information

Each of these data types has associated with it particular sources and objectives to be achieved through its use. In the following, we briefly discuss the task of detailing sources for possible computerization.

Student Data Base

The student data base for a school contains information about each student that profiles the person and the relationships of the person to the school, the community, and the curriculum. The bulk of this information usually comes from five major sources (or points in time):

1. Registration
2. Class Scheduling
3. Attendance Recording
4. Grading
5. Fee Assessment and Accounting

In detailing this data base for possible computerization, one must consider the following elements

1. Data required about each student; personal and home identification information; school identification and location information; curricular placement and completion information.
2. Data on the district; number of schools; students per school; teachers per school; courses per building; course sections per building.

3. Persons involved in each data transaction; time and conditions under which data arises; preferred or suggested means of handling data at the time and place.

4. Reporting documents needed; use made of each; the volume of each document and the frequency with which each is needed.

5. The processing mode required-batch, individual, or both (computer people refer to the individual processing mode as the interactive or on-line mode).

(Appendix A contains a description of documents likely to result from a student data base.)

Each student record (whether in a computer or in a file cabinet) must include all information about the student that is both useful and proper to have. In a well-designed student information base, this easily can excede 25-30 pieces of information about each individual. The individual and family identification information originates at the time the student first registers in the school or district. Thereafter, provision must be made for both regularly and irregularly occuring additions, alterations, or deletions.

Financial Data Base

The financial data base for a school district can be conceived broadly as being made up of all information having direct or indirect influence on the flow of monetary resources. This information base can be divided into two parts as follows:

1. Operating data base

2. Management data base

The operating data base consists of all information concerned with current financial transactions. Included is all information concerned with payroll, budgets, and procurement of resources and services from others. In most school districts, the structure and contents of these data bases are determined by regulations or recommendations from other levels of government. More and more, conditions are being imposed upon financial operating information procedures from both the state and federal agencies, even to the extent of standardizing code numbers used in charts of accounts.

The management data base draws information from several other data bases and aggregates it into a form usable for projecting conditions into the future. From this data base, decisions are made on future policy. In a paper-based information environment, this data base may contain only bare-bones information about past and present conditions in a form that will permit some contemplation of, or experimentation with, policies influencing the future. Although no attempt at prediction of future financial, population, or personnel matters can be totally accurate, a well-designed, computerized, management data base can add significantly to the accuracy of predicting the effects of policy changes of one form or another.

In Appendix A, we present an example list of data documents typically resulting from the financial data base of a school district.

Personnel Data Base

The personnel data base contains all information accurately describing each employee and his relationship to the school or district. Several types of information are included:

1. Personal identification data
2. Professional identification and qualification information
3. Current assignment data
4. Alternate utilization data

In a typical school district, portions of this information likely will be found housed in a variety of locations, having been gathered at different times and, perhaps, in seemingly unrelated forms. This reduces the actual level of knowledge about the staff that may be derived from the information.

Data documents usually resulting from uses of a personnel data base are listed in Appendix A.

COMPUTERIZING ADMINISTRATION

Many schools already have computerized their administrative information processing. A variety of differing strategies have been followed with widely varying success. Generally, those situations producing less than satisfactory results are attributable to a missing or vague description of the information task being computerized.

There are two basic models of information flow in schools:

1. The "trickle-down" model--Information is collected and processed near the top of the administrative structure and the results flow down to various end users.

2. The "percolate-up" model--Information is collected and processed at the source, processed for the needs at that point, then passed to other administrative levels for appropriate processing at each level.

Until recently, the hardware available for school administration generally has mandated the trickle-down style of information processing. Data on students, attendance, scheduling, finance, or personnel is gathered at a variety of foci in the schools. This information may be coded or otherwise rendered "machine readable" at the origination point, but little machine processing usually is present there. Instead, the raw information is passed to a central place, processed in a batch style, and the needed results sent back to the users at the origin of the data source.

Major difficulties experienced with this style of information processing include:

1. Processed information is slow in returning to the users.

2. The batch data entry style tends to encourage excess manual handling of the data (sorting, classifying, etc.) outside of the computer.

3. Individual pieces of the data base are difficult to access and alter in relation to the rest of the data base.

None of these characteristics is dictated by present day information processing techniques.

The Trickle-Down Model

As defined earlier, this model is built on the conception that a computer is at some central location taking in raw information, processing it, and sending back the results. One place that the model greatly can be improved by current technology is in the data gathering and entry stages. Large quantities of school data are gathered on an individual basis. Student schedules are formulated in individual conferences. Attendance is recorded individually. Only occasionally does a large quantity of like information become available at one time. In all these cases, however, the data usually is prepared through a keyboard of some form. Traditionally, this has been a keypunch machine which coded cards. A better model requiring no more clerical time is to enter the data interactively (through a terminal) at the time it is gathered. Even at yearly registration time, individual data can be typed as it is gathered (similar to the registration process at hospitals today). An advantage to this style is that the data base evolves over time. At any instant it can be processed in order to view current trends.

Generally, the trickle-down style administrative computing requires a large computer supporting an array of communication devices dispersed in the school community. Usually, these devices employ some telephone communication. This can add significant expense to the total cost of information processing unless the system is designed to use telephones infrequently and briefly. Also, the complexity of the hardware and software of such a design normally warrants highly trained computer specialists at the central processor to maintain operation.

The Percolate-Up Model

In contrast, this model of information processing in schools strives to decentralize or distribute the processing of information to the sources and points of use. To illustrate, consider the simple case of attendance information. This data originates in each school, and much of it initially is used at the school level. Each day, the attendance data is gathered, sorted, processed in a variety of ways, and reported to the classroom teachers, counselors, and parents. Some summaries of this data are needed at higher administrative levels in the district. Processing can be done at the originating level. The central site computer can then be provided with either a duplicate of the entire local data base or selected information as required. The important point is that those involved in the origination and day-to-day use of the data need never loose immediate touch with it.

In this model of information processing, facilities must be tailored so that site personnel can conduct all information processing tasks. In the most simplistic form, data bases would be passed up the administrative ladder on inexpensive data recording devices such as floppy diskettes.

SELECTING COMPUTER SYSTEMS

As computers have entered into education, many uncomfortable or embarrassing moments have been experienced by school personnel. Lack of knowledge of computers and what they do has been a major source of such difficulty. Still greater problems have stemmed from vague ideas or descriptions of the intended uses of the equipment. These frustrations can be minimized.

When considering computerization in school administration, one of the best places to begin is with a detailed study of the sources, forms, and uses of information in the environment. Included in this task should be details of the purposes of each piece of information handled in the environment, its volume, its frequency of occurence, and the appropriate processing modes (batch, interactive, or both). The description also should detail the form, purpose, volume, frequency, and processing mode of all reports of information used in the schools. Samples of these reports should be included wherever possible.

When conducting information sources and uses analysis, it is a good idea to look broadly around all facets of school business including many instruction-related activities. One should futurize a little bit and consider, for example, computerized inventory of football or band uniforms, the libraries, the science laboratories, and the industrial arts programs. The same star-gazing should be done with information tasks in all administrative offices. Even though not all such services may be automated at the onset, this kind of analysis helps to determine possible future expansion needs.

A second important outcome of this data analysis is that it provides a basis for determining the sizes and forms of the various required data bases. Requests for bids should concentrate on the school's information requirements rather than on the hardware or software specifications. The school person generally has too little specific knowledge to do a good job of writing specifications. His knowledge is of the task to be performed and the information required and used. It is these that should be described for the potential vendor. With such information, a vendor is in an excellent position to advise on difficult issues such as memory size, processing power, and the amount of data storage needed. The vendors then provide system specifications.

Another matter for careful consideration by the administrator is the requirements of the peripheral devices. These are the terminals, the printers, perhaps optical reading devices, etc. Again, one should approach the matter from the perspective of task requirements. For example, consider the printer. How fast a printer does one need? This can be estimated by taking the

longest single printing job to be done. Let's say it is the printing of the opening day class and student registers. In a typical school, this might include the following:

Division Lists:

1. Homeroom assignment lists to post at entrances and in hallways.
2. Master address and telephone number lists for counseling department.
3. Homeroom teacher's register.
4. Attendance officer's register
5. Book assignment (or rental) registers.
6. Address and phone registers for office personnel.
7. Age lists for P.E. Department team assignments.
8. Spare copy of each of the above for security filing.

Class Lists:

1. Each subject teacher.
2. Counseling office.
3. Security files.

Timetable Print-Outs:

1. Student copy.
2. Office copy.
3. Counselor copy.

Summary Tables: (two or three sets).

Suppose further that the administrator would like these accurate to the day prior to the opening of school. An estimate would procede as follows:

Number of lines of information on a particular list $\times$ Number of copies of that list $=$ Number of lines of print on one production of that form

This calculation is done for each list or form required for opening day, and the results are summed. The result is the total lines of printing required for opening day.

Now, since we wish this accurate to the previous day, there are at most 24 hours (1440 minutes) in which to do the printing job. So, we would divide total lines of printing by 1440 to get the lines per minute rate required of a printer. If this task is to be conducted during the business day, then the divisor will be considerably smaller than 1440 minutes and the printer will need to be considerably faster. One will need to compromise some of these requirements if this raises the total cost beyond reasonable limits.

In summary, our advice relative to selection of computer hardware is to concentrate efforts on describing information requirements in as much detail as possible. This will require less technical knowledge and help to avoid gross oversights.

Software

No computer system will work without detailed information on what to do. These instructions are in the form of computer programs. There are three common sources of such programs:

1. The hardware vendor
2. An independent software vendor
3. In-house programs.

Whatever the source, software is expensive and we rapidly are approaching a time at which it is the major expense of computing services. Again, problems in procurement can be minimized by careful definition of the tasks to be done by the computer. While doing this analysis, some time should be spent considering how technical (or standard) are the desired information processing methods. The more one's software requirements match those of other users, the less will have to be paid. Customized software is very expensive. This is particularly important from the viewpoint of future expansion or alteration of information services. Standard software more likely will fit a variety of hardware. Also, standard software more likely will inexpensively integrate with new software you might purchase later.

When requesting bids for major software systems, it is wise to solicit from both hardware and independent software vendors. All such bids should be priced separately so that individual items may be compared. If it is necessary to postpone implementation of some information services until a later date, separate pricing gives a basis for the decisions.

Performance Requirements

One place that schools typically have problems with computers has been in establishing performance deadlines or conditions. Frequently, these are overlooked. At best, they may be vaguely defined.

For both hardware and software, requirements should include a statement of the performance conditions under which the service will be accepted. A combination of quality and duration specification is desired. So, for example, a hardware requirement might specify one month continuous fault-free operation of the hardware. The vendor, in his bid, might then define still further unrelated events over which he can exercise no control (e.g. power failure). Similar expectations should be specified for each major software system (financial, personnel, scheduling, etc). It is not unreasonable to make partial payments contingent upon achievement of a succession of such requirements.

Beyond these individual service performance requirements, overall time for successful implementation of the services singularly or collectively may be an important consideration. In all cases of performance definition, it is important to expect and specify penalties for failure to comply with service conditions and deadlines.

Closely related to performance of hardware and software systems is the issue of maintenance. Both hardware and software can need fixing sometime. How available is such service, how rapidly does it respond, and how much does it cost? Typical hardware maintenance agreements will specify service visits within 24 hours. What does this mean? Does a repairman come, find the problem, and then order the replacement parts? Or, does it mean that the operation is resumed within 24 hours? There is a large difference. The monthly fee for typical hardware maintenance agreements can be 1.5% to 2-3% of the purchase price.

Estimating Quality of Service

There are several ways to test the quality of service offered by a potential vendor. One of the major of these is customer satisfaction. Ask for names of installations of the hardware or software you seek. Then take the time to go see the services in operation and to talk to those involved employees. Even in specifying requirements for peripherals such as terminals, it is a good idea to go look at, and to use, models of a variety of types and characteristics. This will give a much better perception of the useful features in the various devices.

Availability of software for hardware systems gives a fairly good indication of the quality of a vendor's services. Vendors with little software to offer may be very new to the business. This can be an advantage or a disadvantage. You might get more personal service for less money from a young vendor. On the other hand, the young vendor might go out of business midway through your implementation.

An excellent measure of both hardware and software is found in the quality of its documentation (e.g. manual, directions, user assistance, etc.). Since most of this documentation will be used by school personnel, it should not take a technical person to interpret what is said. Test the various documents on your staff to see if they understand them. Attendance software documentation should be comfortable to attendance clerks. Scheduling documentation should be comfortable to the counseling office staff, and so on.

Closely related to customer satisfaction is dealer dependability. Again, you must assume responsibility to investigate among other customers. How accurate are the vendor's statements about system features, availability, service, and so forth? Sometimes customers will be satisfied by an unreliable dealer.

Operating Personnel

An additional consideration when purchasing an instructional computer system is the requirements of the person in charge of operating and maintaining the system. The operating personnel must have knowledge of the operation of the specific machine and peripheral equipment. The following suggest some procedures with which the personnel should be intimately familiar:

1. Dead Start (boot-up)
2. Restart from system failure
3. "Back-out" or shut down
4. Interfacing and operation of peripherals
5. Emergency shut down

The personnel should have knowledge of the procedures as well as knowledge of the potential failures which could occur during operation.

In the case of a system failure or partial interruption, the operating personnel should possess the trouble shooting ability to identify the inoperative part(s). Most systems have available diagnostic routines (e.g., memory tests) which aid this trouble shooting process. The operator should be familiar with the routines and the expected results of individual tests. Once the malfunctioning part is identified, the operator should be able to determine if he/she can easily replace or repair the part or if a service call is necessary.

Preventive maintenance also is an important activity for the operator. Although electronic components of a system usually require little attention, the mechanical components and the "environmental" components (e.g., filters, cooling fans) do require maintenance. Moving parts must be lubricated or adjusted, printer ribbons must be changed, disk or tape reader heads must be cleaned, etc. A good schedule for preventive maintenance will reduce the failure rate of a system.

With regard to hardware, the operator will probably be the choice for the contact between the vendors and the school system administrative personnel. The operator thus should possess the knowledge of existing alternatives for services for the particular system. Also, the operator should be familiar with the provisions of the current contracts for the purchased equipment as well as any agreements from the vendors of services.

As an adjunct to the knowledge of specific hardware procedures, the operator must be completely familiar with the software used by the system. Knowledge of machine (assembly) language will be necessary or useful when creating or altering system operating routines. (Especially in the case of a vendor not supporting the supplied software or not supporting alterations to the supplied software.) Some often used sophisticated programs (e.g., data sorting routines or data searching routines) are sometimes supplied by a vendor only in machine code. (Programs written in machine code or assembly language tend to operate internally more efficiently than a higher level language counter-part.)

Of course, the operator should be an expert programmer in the higher level languages (BASIC, FORTRAN, TUTOR, APL, etc.) available with the hardware. The operating personnel will be called upon frequently to assist novice programmers as they develop programs for the system.

Since the computing system is operating in an educational setting, it is desirable, but not necessary, to have operating personnel who possess instructional design (courseware) knowledge. Designing a computerized lesson, although somewhat similar to a non-instructional program, requires expertise from the field of

education normally not possessed by conventional computer science specialists. Also, this expertise will be useful in understanding the varied requirements of an instructional system as opposed to the requirements of a more business oriented data processing system. This understanding will facilitate communication between the instructional staff and computer operations staff.

Finally, a major role of the computer operations personnel will be as managers and facilitators of computer services. The operator should facilitate the interaction of the instructional or lesson authoring staff with the computer. The following illustrate some of the possible ways in which this interaction might be accomplished:

1. Special sign-on procedures for instructors or authors.

2. A lesson "scanning" routine to permit instructors quickly to view a lesson without the slowing procedure involved in answering all of the questions in the material.

3. Special "mini-manuals" or quick reference sheets for the computer programming language of the system covering the syntaxes for often used commands.

4. Provide an easy editing feature for textual material or programs.

5. Provide a "language free" authoring system (e.g., CAISP, IDF, PILOT).

The student population must also be provided with an easy procedure when using the computer. The use of router or "menu" lessons or the use of multiple or group sign-ons and automatic lesson selection are possible ways in which student use can be facilitated.

As managers, the operating staff must be responsible for maintaining and for allocating the computer resources. The following are some of the possible duties in this area:

1. Assignment of sign-ons and possible passwords.

2. Allocation of storage space (disk or tape space) for programs.

3. Maintenance of appointments or reservations for limited equipment or resources.

4. Maintenance of file privacy and security (e.g., personnel data files, test programs, salary information).

5. Maintenance of necessary program documentation for all programs on the system with special attention to system level programs.

6. Maintenance of service logs and preventive maintenance schedules.

7. Upgrading often used programs or migrating (moving to back-up systems) those seldom used programs.

As can be seen from this discussion, the selection of operating staff is extremely important for the maintenance of the system as well as to the facilitation of its use by other personnel.

SUMMARY

Schools, increasingly, are availing themselves of computers for use in administration and instruction. Some are not totally satisfied with the services they receive. Frequently, dissatisfaction stems from failure to concentrate on an analysis and definition of information uses and requirements before equipment is sought. This paper has attempted to focus attention on this requirement-defining process. Beyond this, we urge you to seek user-oriented assistance from others like you who might have computerized before you.

**

APPENDIX A

Descriptions of School District Data Base Documents

These lists of data documents are intended to suggest a variety of data uses and are not intended to be exhaustive.

Student Data Documents:

1. Course request documents for students.
2. Course request tally list (used to build master class schedule).
3. Course request conflict list (student registers having duplicate, faulty, or conflicting choices).
4. Course conflict table (numbers of conflicts among each course).
5. Parent report of student course selections.
6. Master schedule lists on classes, teachers, rooms, periods.
7. Room, teacher, period conflict lists.
8. Class size reports.
9. Free period summaries.
10. Unscheduled student list.
11. Student schedules.
12. Class lists and grade report lists.
13. Pupil attendance reporting documents.
14. Student grade forms.
15. Excessive absence reports.
16. Cumulative attendance lists.
17. Failure-incomplete notices.
18. Grade distribution lists by course.
19. Grade distribution lists by department.
20. Class rank lists.
21. Honor roll lists.
22. Permanent record labels.
23. District enrollment information.

24. Transportation reports.

25. Student fee statement.

26. Student fee summary report.

27. Student fee delinquent report.

28. Graduation credit check.

Financial Data Documents

1. Payroll checks and stubs.
2. Taxing body treasurer's report.
3. District check register.
4. Accounts summary list of wage distributions.
5. Accounts item lists of wage distributions.
6. Fund summary of wages and deductions.
7. Pension fund reports (monthly and accumulated).
8. Social Security quarterly report.
9. Payroll deductions summary list.
10. Monthly W-2 data balancing.
11. Bank's reconciliation documents.
12. Employee identification verification list.
13. State and federal W-2 forms.
14. Employee roster.
15. Salary range publication list.
16. Employee sick leave accumulation list.
17. Employee vacation accumulation list.
18. Verifying lists of salary data base changes.
19. Account listing paid invoices.
20. Vendor checks and stubs.
21. Vendor check register.
22. Vendor ledger reports.
23. Vendor file labels.
24. Accumulated purchases by vendor list.
25. Chart of accounts report (in sequence).

26. Chart of accounts report (by school or program).

27. Partial chart of accounts report (for government agencies.)

28. Summarized chart of accounts.

29. Program specific account activity ledger.

30. School specific account activity ledger.

31. Account activity ledger (in sequence).

32. Open order request.

33. Budget preparation work report.

34. School specific program summary reports.

35. School activity funds reports.

36. Equipment inventory reports.

37. Equipment depreciation reports.

Personnel Data Documents

1. Teacher contract information list.
2. Teacher professional growth status list.
3. First year teachers' status list.
4. Second year teachers' status list.
5. Teacher probation list.
6. Individual contract verification forms.
7. Teacher service record.
8. New employee list.
9. Teacher certification report.
10. Personnel directory.
11. Staff mailing labels.
12. Salary matrix.
13. Equal employment opportunity report.
14. Teacher retirement list.
15. Staff statistical reports.
16. School recognition reports.
17. Staff reimbursement claims reports.
18. Staff age matrix.
19. Employee's earnings report.
20. Specialized staff lists.

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